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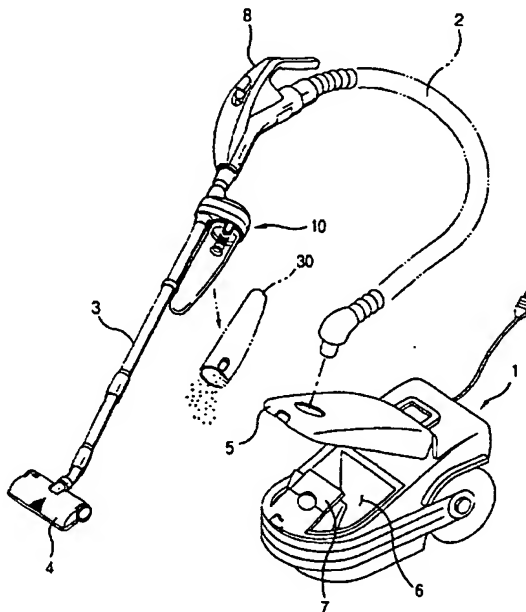
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(54) Abstract Title

**A cyclone dust collecting device positionable at the extension pipe of a vacuum cleaner**

(57) A cyclone dust collecting device positionable non-coaxially at the extension pipe connecting the suction opening and the main body of a vacuum cleaner to allow access to empty the device without removing it from the extension pipe. The device 10 comprises first and second connecting tubes connected to the extension pipe 3 and a dirt collecting tub 30 combined to the cyclone body to be removable for emptying. The cyclone body has an air inlet communicating with the first connecting tube through which dirt-containing air enters from the suction opening 4 and an air outlet communicating with the second connecting tube through which cleaned air exits to the main body 1 of the vacuum cleaner. A dirt separating grill having a plurality of minute passing holes may be formed at the air outlet of the cyclone body.

FIG.2



GB 2 344 278 A

1/12

FIG. 1

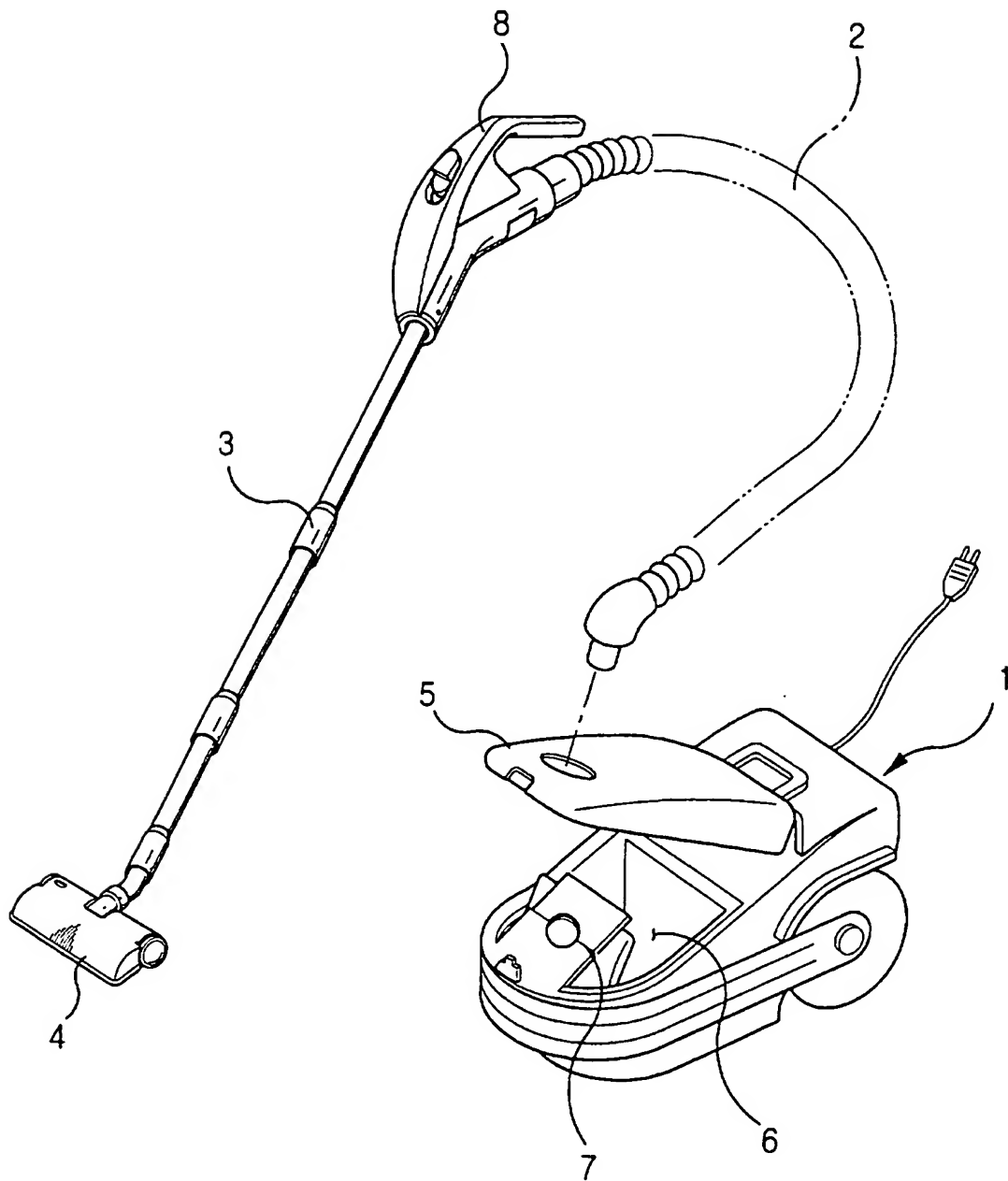
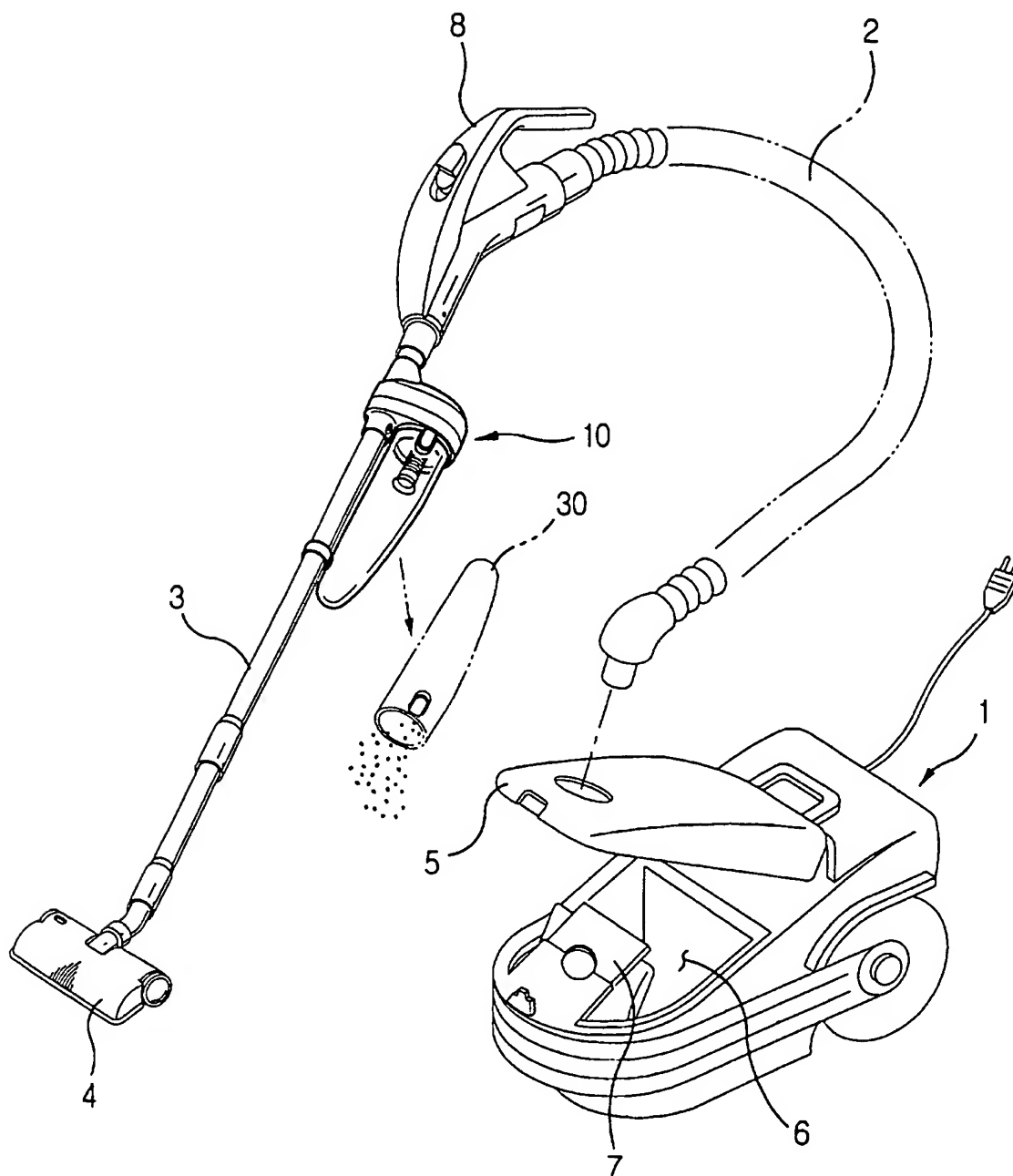


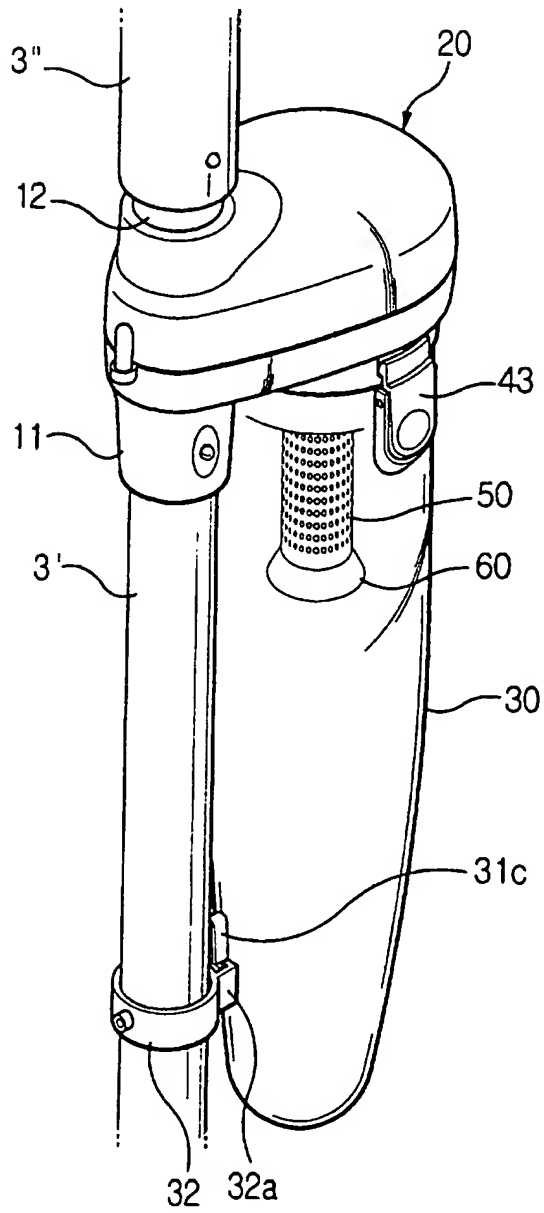
FIG.2





4/12

FIG. 4



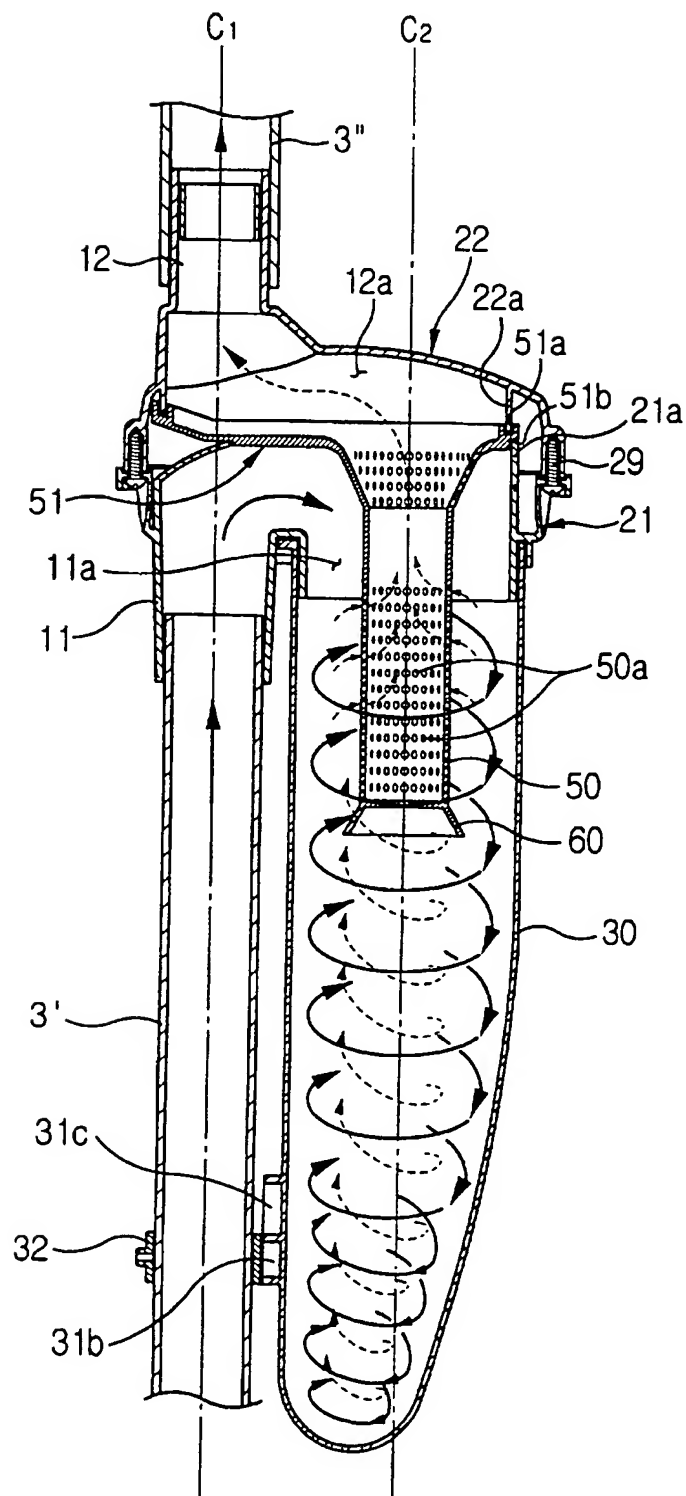
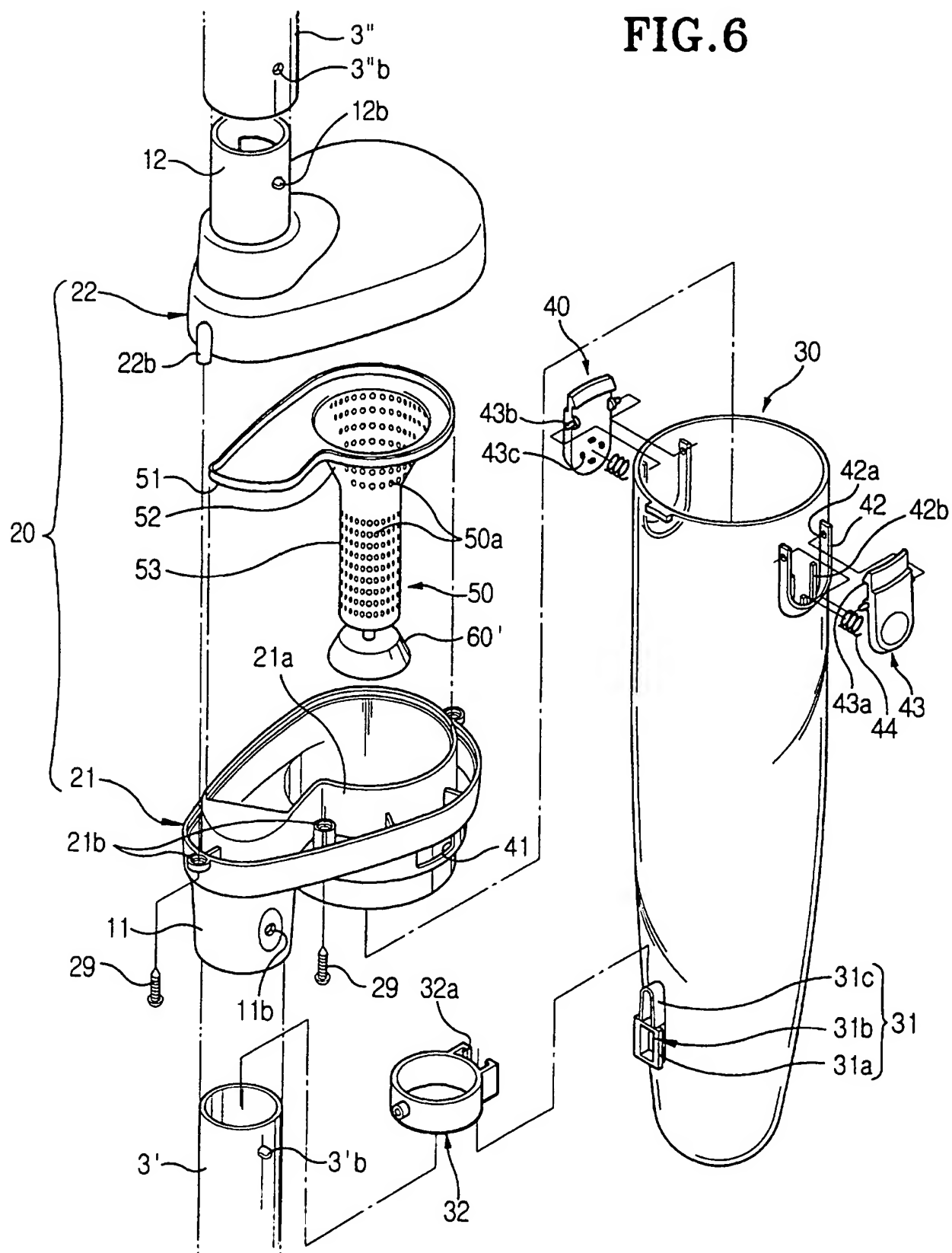
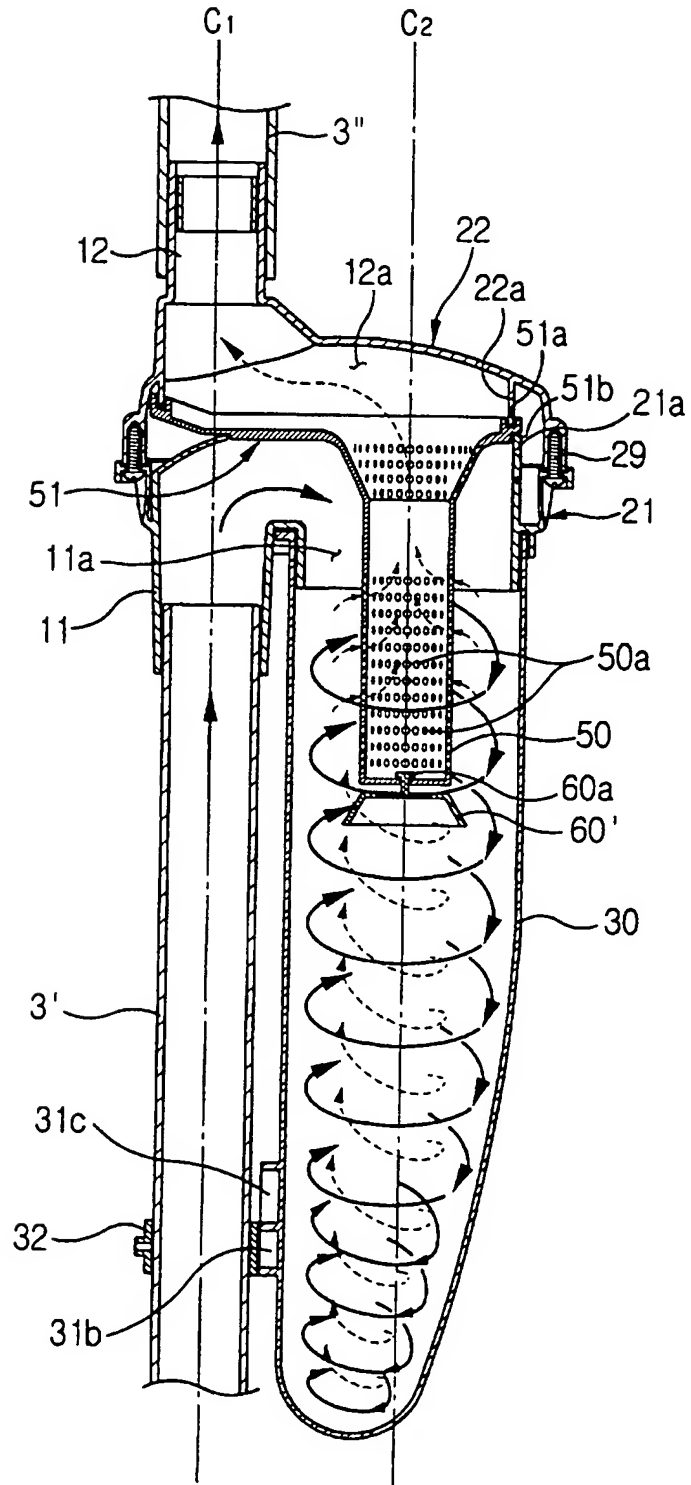


FIG.6



7/12

FIG. 7





8/12

FIG. 8

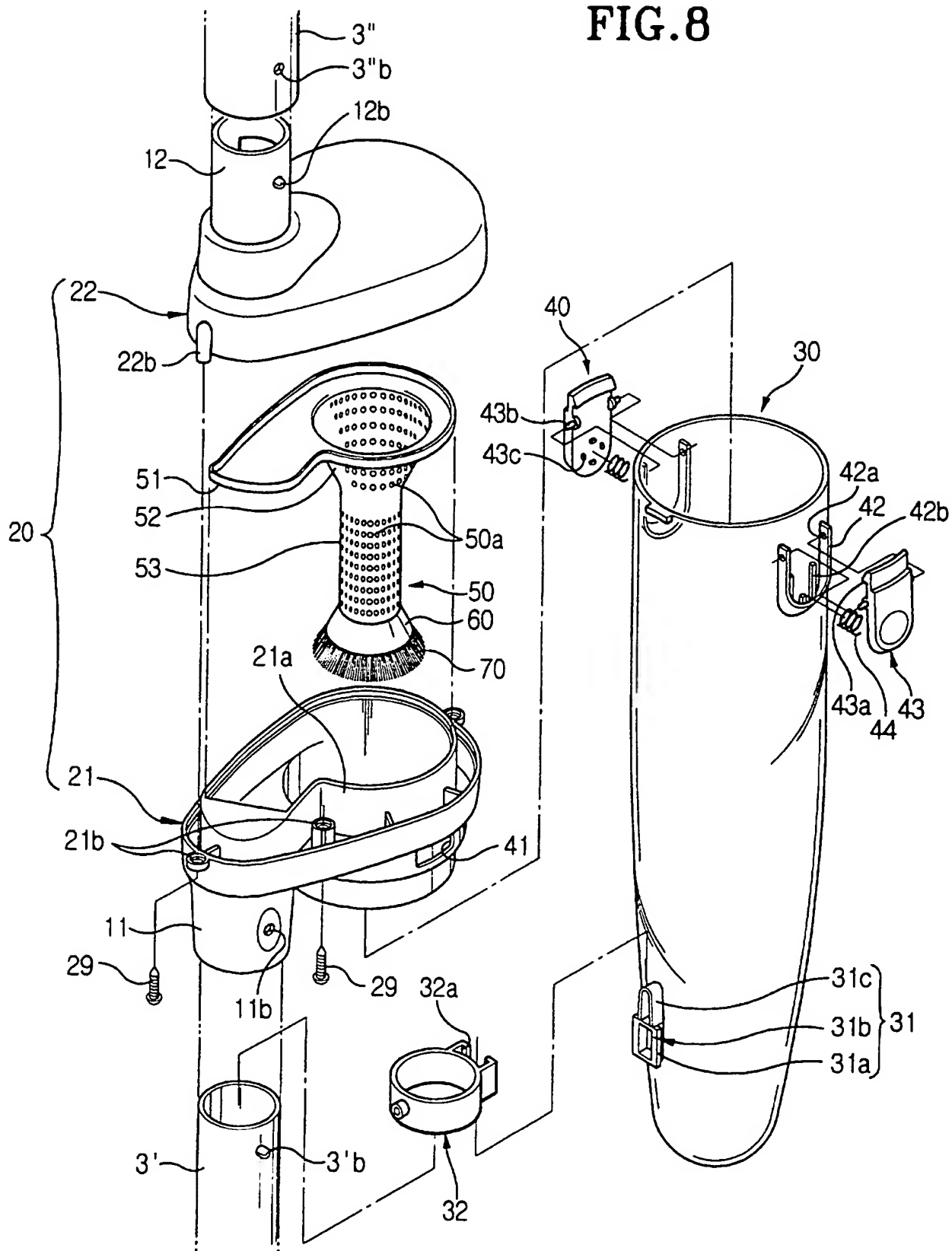


FIG. 9

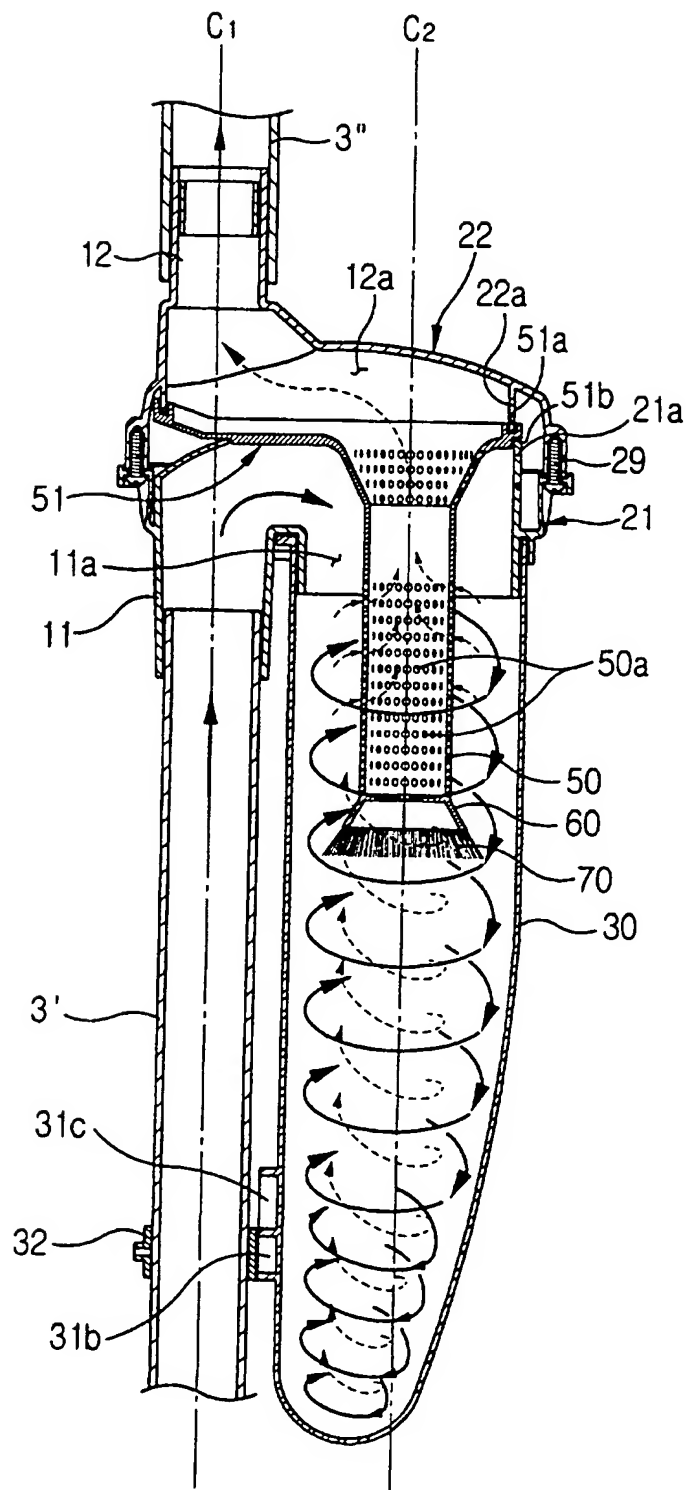
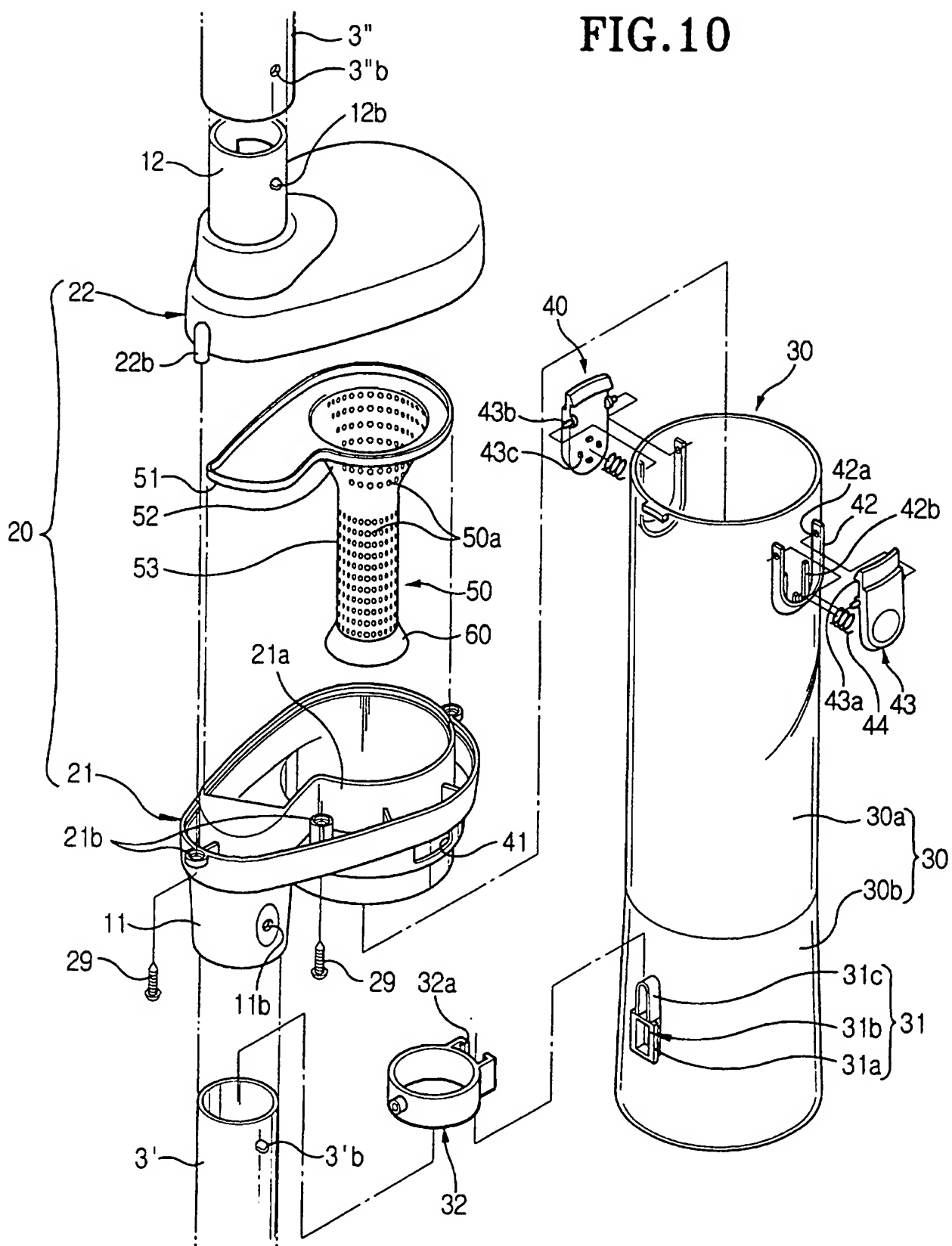
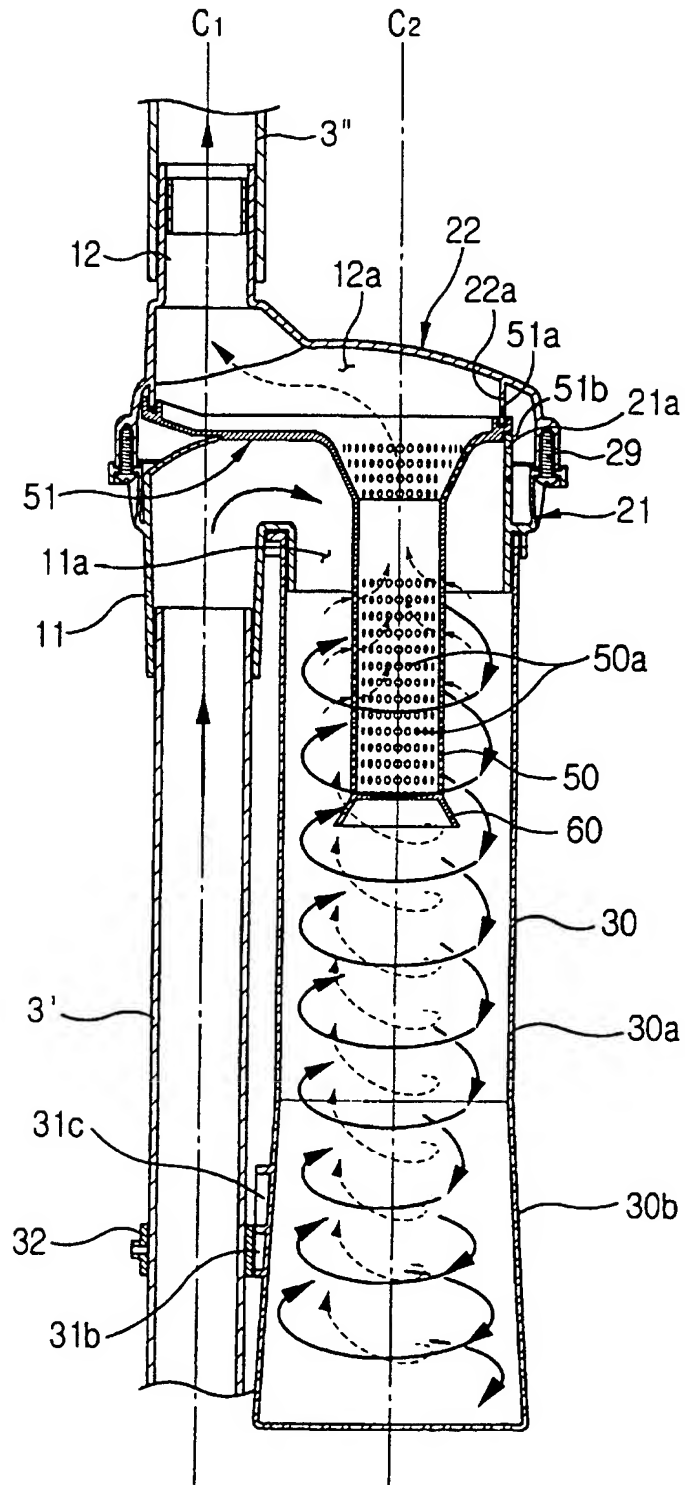


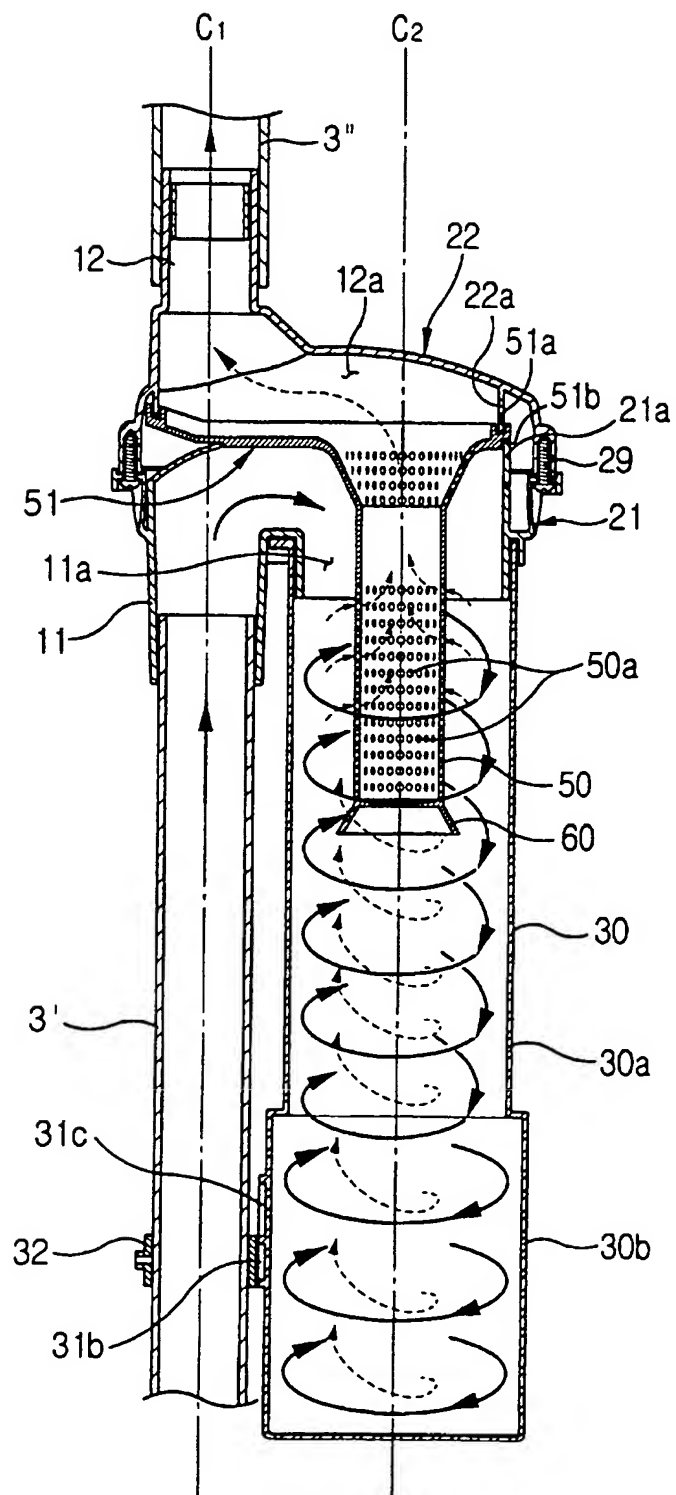
FIG. 10



11/12

FIG. 11





VACUUM CLEANER HAVING A CYCLONE DUST COLLECTING DEVICE

The present invention relates to a vacuum cleaner, and more particularly to a vacuum cleaner having a cyclone dust collecting device which primarily catches and collects dirt or dust of comparatively large particle size or refuse such as toilet paper, vinyl, and hair.

A general vacuum cleaner, as shown in Figure 1, has a main body 1 of the cleaner, a connection hose 2 connected to the main body 1, a plurality of extension pipes 3 connected to the connection hose 2 and a suction opening 4 connected to the end of the extension pipe 3. A cover 5 is mounted on the main body 1 to be able to be opened and closed and the connection hose 2 is connected to the cover 5. A dust collecting chamber 6 is disposed inside of the main body 1 and a paper filter 7 which collects dirt or dust is placed to be removable in the dust collecting chamber 6. A reference numeral 8 represents a handle.

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The general vacuum cleaner as described above suctions dirt together with suction air via the suction opening 4 by the suctioning power of a motor (not shown) installed inside of the main body 1. The suctioned air and dirt enter the main body 1 via the extension pipes 3 and the connection hose 2. Here, the dirt is collected at the paper filter 7 in the dust collecting chamber 6 of the main body 1 and the suctioned air is exhausted to the outside of the main body 1 of the cleaner via the paper filter 7.

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In the general vacuum cleaner as described above, however, since the dust and dirt suctioned via the suction

opening 4 are all collected at one paper filter 7 in the dust collecting chamber 6 of the main body 1, the paper filter 7 can be easily filled with the dirt. If the paper filter 7 is filled with the dirt, the suctioning force becomes deteriorated and the motor may be overloaded. For this reason, the conventional vacuum cleaner is somewhat inconvenient in that the paper filter 7 requires frequent replacement.

10       With a view to solve the above problem, a vacuum cleaner having a cyclone dust collecting device has been proposed. A cyclone is a device for separating particles in a fluid by using the centrifugal force. This device has a simple structure and tolerates high temperature and high  
15       pressure. So, it has been widely used as a dust collector in the industry field and for vacuum cleaners.

Such a cyclone vacuum cleaner is constructed so as to primarily catch and collect dirt of comparatively large  
20       particle size suctioned via the suction opening before the dirt enters the paper filter in the main body of the cleaner. Thus, the quantity of the dirt collected at the paper filter can be reduced and the paper filter can be used for a long time. Further, it has an advantage that  
25       the deterioration of the suctioning force and the overload of the motor can be prevented.

Representative examples of cyclone vacuum cleaners as described above are described in Korea Patent No. 1993-  
30       4891 (the title of which is Vacuum Cleaner having Cyclone) and Korea Patent No. 1993-5099 (the title of which is Vacuum Cleaner).

The former (No. 93-4891) is structured such that a cyclone which can separate and collect the dirt is positioned coaxially with respect to the connection pipe of the cleaner. The cyclone has an outer tube, an inner tube disposed within the outer tube, a hopper placed at the lower portion of the inner tube, a suction hose for connecting the head of the cleaner to the outer tube, a vortex finder placed to pass through the inner tube and the top of the outer tube, and a cyclone inlet formed at one side of the inner tube. In such a vacuum cleaner, dirt of large particle size suctioned via the suction opening is caught and collected by the cyclone, thereby reducing the quantity of the dust collected at the paper filter in the main body of the cleaner.

In the meanwhile, the latter (No. 93-5099) is structured such that a dirt separating and collection device for separating and collecting the dirt is disposed at the connection pipe which connects the main body of the cleaner to the suction opening. The dirt separating and collection device has a case which has internal first and second dust collecting chambers, a vortex finder formed on top of the case, a connecting unit formed at the lower portion of the case to communicate with the first dust collection chamber, a cyclone separator which is received within the case and has a conical structure in which the inside diameter is gradually reduced from the upper portion to the lower portion thereof, a hopper which is combined to the lower end of the cyclone separator and has a conical structure in which the inside diameter is gradually increased from the upper portion to the lower portion thereof, an inlet filter which is combined to the center of the cyclone separator to separate the first dust



collecting chamber from the second dust collecting chamber, a filter which is combined to the top of the cyclone separator to separate the second dust collecting chamber into two, and a vortex brake formed at the lower  
5 portion of the cyclone separator. This vacuum cleaner also catches and collects the dirt of large particle suctioned via the suction opening by the dirt separate collection device, thereby reducing the quantity of the dust collected at the paper filter in the main body of the  
10 cleaner.

In conventional cyclone vacuum cleaners as described above, however, since the cyclone (or the dirt separating and collection device) is coaxially placed at the  
15 extension pipe of the cleaner, the cyclone (or the dirt separating and collection device) should be completely separated from the extension pipe of the cleaner to remove the dirt collected inside thereof.

20 In addition, the cyclone (or the dirt separating and collection device) of the conventional cyclone vacuum cleaner has a complicated structure, causing the difficulty in manufacturing and the increase on the manufacturing cost.

25 Accordingly, an aim of embodiments of the present invention is to provide a vacuum cleaner having a cyclone dust collecting device which can simply remove the dirt collected at the dust collecting device without completely  
30 separating the cyclone dust collecting device from an extension pipe of the cleaner.

Another aim of embodiments of the present invention is to provide a vacuum cleaner having a cyclone dust collecting device which has a simple structure so that it can be easily manufactured and is more profitable for mass production due to lower manufacturing costs.

According to a first aspect of the invention, there is provided a cyclone dust collecting device positionable within an extension pipe connecting a main body of a vacuum cleaner and a suction opening, the cyclone dust collecting device being arranged to separate and collect dust and dirt of comparatively large particle sizes suctioned from said suction opening together with air by means of centrifugal force, the cyclone dust collecting device being characterised in that the device does not share the same central axis as the extension pipe and that dirt collected within said cyclone dust collecting device may be conveniently removed without requiring separation of the device from said extension pipe.

The invention includes a vacuum cleaner including a cyclone dust collecting device according to the first aspect.

According to another aspect, there is provided a vacuum cleaner which has a cyclone dust collecting device which is placed at an extension pipe for connecting a main body of the cleaner to a suction opening and separates and collects dust and dirt of comparatively large particle size suctioned via the suction opening by the centrifugal force. The cyclone dust collecting device is positioned non-coaxially with respect to the extension pipe of the cleaner, so that it is possible to remove the dirt

collected by the cyclone dust collecting device without completely separating the cyclone dust collecting device from the extension pipe.

5       The cyclone dust collecting device preferably includes a cyclone body having first and second connecting tubes connected to the extension pipe of the cleaner, a dirt collecting tub combined to the cyclone body to be removable, and locking means for supporting the dirt  
10   collecting tub.

      The cyclone body is preferably separated into an upper body unit and a lower body unit and the upper and lower body units are assembled by a plurality of screws.  
15   An air inlet communicating with the first connecting tube is preferably formed at the lower body unit and an air outlet communicating with the second connecting tube is formed at the upper body unit. The first connecting tube is preferably connected to the extension pipe near the  
20   suction opening of the cleaner and the second connection tube is connected to the extension pipe near the main body of the cleaner. The dirt-containing air suctioned via the suction opening of the cleaner preferably flows in via the air inlet of the cyclone body in an oblique direction  
25   against the cyclone body, so that the whirlpool air current is formed inside of the cyclone body. By such a whirlpool air current, the dirt contained in the air is separated from the air by the centrifugal force and then is collected at the dirt collecting tub, and the air  
30   starts the reverse rising movement from the bottom and is exhausted via the air outlet.

In this case, the dust may flow upstream together with the air via the air outlet of the cyclone body. To prevent this problem, the cyclone dust connecting device of the present invention preferably includes a dirt separating grill having a plurality of minute passing holes which is placed to be downwardly extended from the air outlet of the cyclone body, so that the air risen from the dirt collecting tub passes through the minute passing holes, while the dirt which is larger than the minute passing holes cannot pass through the minute passing holes and are descended again to be collected at the dirt collecting tub.

Further, dirt blocking means for blocking the dirt risen together with the air before it reaches the dirt separating grill and then descending the dirt again is preferably formed at the lower portion of the dirt separating grill. Accordingly, rubbish such as toilet paper cannot completely rise to the upper portion of the cyclone body and is blocked to be descended again. Therefore, it is possible to remarkably reduce the quantity of the dirt which flows upstream via the minute passing holes of the dirt separating grill and prevent the toilet paper or the like from blocking up the minute passing holes of the dirt separating grill.

The dirt blocking means may be structured such that a dirt blocking plate of conical shape wherein the width is increased as it goes from the upper portion to the lower portion is formed at the lower end of the dirt separating grill to be united into one, or such that an additional conical dirt blocking rotation plate is placed at the lower portion of the dirt separating grill to be rotatable

by the whirlpool air current. In addition, a supplementary blocking member may be placed at the lower portion of the dirt blocking plate or dirt blocking rotation plate. The supplementary blocking member may be formed of brush and placed to be widely distributed with maintaining the same angle as the downward extension unit of the dirt blocking plate or dirt blocking rotation plate.

The dirt collecting tub is preferably formed to be a cylinder shape and to have the solidity not to be easily broken by the external impact. A supporting unit for supporting the dirt collecting tub against the extension pipe is preferably formed at one side of the lower portion of the dirt collecting tub to be united into one. The supporting unit is preferably inserted to a slide groove of a fixing ring which is to be fixed to the extension pipe and is assembled to the cyclone body by combining the upper portion of the dirt collecting tub to the cyclone body by locking means. The dirt collecting tub may be formed to be a cylinder shape with a predetermined diameter or to be a lower portion reducing shape tube wherein the diameter thereof becomes reduced as it goes from the upper portion to the lower portion. In addition, the dirt collecting tub may be formed to be a lower portion extending shape tube wherein the diameter of the lower portion is greater than that of the upper portion. In the case of the lower portion extending shape tube, the rotation speed of the air in the dirt collecting tub can be reduced as it goes to the lower portion, thus preventing the backward flow of the dirt. The lower portion extending shape dirt collecting tub preferably has a first cylinder unit which is formed at the upper portion and a second cylinder unit which is formed at the lower

portion and has a diameter greater than that of the first cylinder. Accordingly, the air suctioned to the dirt collecting tub rotates in the first cylinder unit at a comparatively high speed to separate the dirt, and the air  
5 rotates in the second cylinder at a slow speed. Thus, it is possible to minimize the quantity of the dirt which has risen with the whirlpool air current. The second cylinder unit may be formed to be such that the diameter of the lower portion becomes greater than that of the upper  
10 portion or to be a simple cylinder shape the diameter of which is greater than that of the first cylinder.

The locking means preferably has a pair of suspension holes formed at both sides of the lower body; a pair of  
15 lockers which are hinge-combined to a pair of locker supporting units formed at both sides of the upper portion of the dirt collecting tub to be united into one and have hooks which are formed at the end thereof and are to be hooked to the suspension holes; and a spring which is  
20 disposed between the inside of the rear end of the locker and the locker supporting unit of the dirt collecting tub and elastically supports the locker in one direction. Here, each locker is preferably elastically supported by the spring in the direction to which the hook thereof is  
25 hooked to the suspension hole of the lower body. Thus, if the dirt collecting tub is inserted to the lower body of the cyclone body, the hook of the locker is inserted to the suspension hole and then the dirt collecting tub is combined to the cyclone body. The dirt collecting tub may  
30 be separable from the cyclone body by pushing and pulling both lockers. Then, the hooks of the lockers may be released from the suspension holes of the lower body and the supporting unit at the lower portion of the dirt

collecting tub is released from the fixing ring of the extension pipe. Accordingly, only the dirt collecting tub can be separated and the dirt collected therein can be conveniently removed.

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According to a preferred embodiment of the present invention, the cyclone dust collecting device for separating and collecting comparatively large particles and dirt suctioned from the suction opening by the centrifugal force is placed in a different axis against the extension pipe. The cyclone dust collecting device preferably includes a cyclone body which has first and second connecting tubes connected to the extension pipe of the cleaner, an air inlet communicating with the first connecting tube and formed at one side thereof and an air outlet communicating with the second connecting tube and formed at the other side thereof and produces the whirlpool air current; a dirt collecting tub which is combined to the cyclone body to be removable and collects the dirt separated from the air; a dirt separating grill which is placed to be downwardly extended from the air outlet of the cyclone body and has a plurality of minute passing holes to prevent dirt from flowing backward to the air outlet of the cyclone body together with the air; a dirt blocking unit which is placed at the lower end of the dirt separating grill, blocks the dirt risen together with the air by the rising air current before the dirt reaches the dirt separating grill and descend it again; and a locking unit which supports the dirt collecting tub to make the dirt collecting tub be removable from the cyclone body.

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According to the above description, since the cyclone dust collecting device primarily catches and collects dusts or dirt of comparatively large particle or the dirt like toilet paper or vinyl, the period for replacing the paper filter of the cleaner can be extended.

Further, if the dirt collecting tub of the cyclone dust collecting device is filled with the dirt, the dirt can be removed by simply separating the dirt collecting tub without completely separating the cyclone dust collecting device from the extension pipe of the cleaner.

For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

Figure 1 is a perspective view showing a general vacuum cleaner;

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Figure 2 is a perspective view showing a vacuum cleaner having a cyclone dust collecting device according to an embodiment of the present invention;

Figure 3 is an exploded perspective view showing a cyclone dust collecting device according to a first preferred embodiment of the present invention;

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Figure 4 is a perspective view showing the assembling of the cyclone dust collecting device of Figure 3;

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Figure 5 is a cross sectional view for explaining the dust collecting operation of the cyclone dust collecting device of Figure 4;



Figure 6 is an exploded perspective view showing a cyclone dust collecting device according to a second preferred embodiment of the present invention;

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Figure 7 is a cross sectional view for explaining the dust collecting operation of the cyclone dust collecting device of Figure 6;

10 Figure 8 is an exploded perspective view showing a cyclone dust collecting device according to a third preferred embodiment of the present invention;

Figure 9 is a cross sectional view for explaining the  
15 dust collecting operation of the cyclone dust collecting device of Figure 8;

Figure 10 is an exploded perspective view showing a cyclone dust collecting device according to a fourth preferred embodiment of the present invention;

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Figure 11 is a cross sectional view for explaining the dust collecting operation of the cyclone dust collecting device of Figure 10; and

25 Figure 12 is a cross sectional view showing a cyclone dust collecting device according to a fifth preferred embodiment of the present invention.

A vacuum cleaner having a cyclone dust collecting  
30 device according to a preferred embodiment of the present invention is shown in Figures 2 to 5.

It is noted that the same reference numerals will be used to designate like or equivalent elements having the same functions. The detailed description thereof will be omitted if possible and the description will be concentrated on the characteristic parts of the present invention.

In the figures, a reference numeral 1 represents a main body of the cleaner, a reference numeral 2 represents a connection hose, a reference numeral 3 represents an extension pipe, a reference numeral 4 represents a suction opening, a reference numeral 5 represents a cover, a reference numeral 6 represents a dust collecting chamber, a reference numeral 7 represents a paper filter, a reference numeral 8 represents a handle grip, and a reference numeral 10 represents a cyclone dust collecting device.

As shown in Figure 2, the cyclone dust collecting device 10 is connected to the extension pipe 3 which connects the main body 1 of the cleaner to the suction opening 4.

The cyclone dust collecting device 10 includes a cyclone body 20 having first and second connecting tubes 11 and 12 which are connected to the extension pipe 3, a dirt collecting tub 30 combined to the cyclone body 20 to be removable, and a locking unit 40 which supports the dirt collecting tub 30 to make the dirt collecting tub 30 be removable from the cyclone body 20.

The first and second connecting tubes 11 and 12 of the cyclone body 20 are formed to be slanted toward one

side from the center of the cyclone body 20. With this construction, if the cyclone dust collecting device is connected to the extension pipe 3 of the cleaner, the center of the cyclone dust collecting device, more concretely, the central axis of the dirt collecting tub 30 is not placed on the axis C1 of the extension pipe 3 but is placed in a different axis, as shown in Figure 5. Thus, there is no need to separate the extension pipe of the cleaner in order to remove the dirt collected at the dirt collecting tub 30. That is, as shown in Figure 2, the dirt can be easily removed by separating only the dirt collecting tub 30 from the cyclone body 20.

The cyclone body 20 is divided into a lower body unit 21 which is united to the first connecting tube 11 and an upper body unit 22 which is united to the second connecting tube 12 and the upper and lower body units 22 and 21 are combined with each other by a plurality of screws 29.

An air inlet 11a communicating with the first connecting tube 11 is formed at the lower body unit 21 and an air outlet 12a communicating with the second connecting tube 12 is formed at the upper body unit 22. Here, the air inlet 11a and the air outlet 12a are formed by dividing the insides of the upper and lower body units 22 and 21 by curve ribs 22a and 21a, respectively. In addition, several pairs of fixing bosses 22b and 21b each having a screw hole at a predetermined position are formed to face each other at the upper and lower body units 22 and 21. A removable hole 11b and a removable projection 12b for combining the cyclone dust collecting device to the extension pipes 3' and 3'' are formed at the first and

second connecting tubes 11 and 12, respectively, and a removable projection 3'b and a removable hole 3''b which correspond to the removable hole 11b and the removable projection 12b are formed at the extension pipes 3' and 3'', respectively.

The first connecting tube 11 is connected to the extension pipe 3' near the suction opening of the cleaner, and the second connecting tube 12 is connected to the extension pipe 3'' near the main body of the cleaner. The dirt-containing air suctioned via the suction opening of the cleaner flows via the air inlet 11a of the first connecting tube 11 in an oblique direction against the cyclone body 20, so that the whirlpool air current (shown as an arrow indicated by a solid line in Figure 5) is generated inside of the cyclone body 20 and the dirt collecting tub 30. By such a whirlpool air current, the dirt of large particle contained in the air are separated from the air and then are descended, while the air is exhausted to the main body 1 of the cleaner via the air outlet 12a of the cyclone body 20 by the rising air current (shown as an arrow indicated by a dotted line in Figure 5) upwardly generated from the bottom.

The dirt collecting tub 30 is combined to the cyclone body 20 to be removable by the locking unit 40. It serves to form the whirlpool air current together with the cyclone body 20 and to collect the dirt separated from the air with the centrifugal force by the whirlpool air current.

The dirt collecting tub 30 is generally formed to be a cylinder shape, but the shape thereof may be varied. But, in consideration of the external appearance, it may be

formed to be a lower portion reducing shape cylinder in which the diameter of the lower portion is smaller than that of the upper portion.

5 Further, in order to easily check the dirt collected inside of the dirt collecting tub 30 from the outside, it is preferable that the dirt collecting tub 30 is made of translucent material, but there is no need to limit the material of the dirt collecting tub 30 to the translucent  
10 material. Also, it is preferable that the dirt collecting tub 30 is made of the material which has a strong solidity so that it cannot be easily broken by the external impact or dropping.

15 A supporting unit 31 for supporting the dirt collecting tub 30 against the extension pipe 3 of the cleaner is formed at one side of the circumference of the lower portion of the dirt collecting tub 30 to be united into one. The supporting unit 31 is inserted to a slide  
20 groove a of a fixing ring 32 placed at the extension pipe 3. The supporting unit 31 includes a fixing projection b having a suspension jaw which is fixed by being inserted to the slide groove a of the fixing ring 32, and a guide projection c which is formed in front of the fixing  
25 projection b to guide the insertion of the fixing projection b to the slide groove a. The guide projection c is formed to be of the shape that the width becomes narrower from the portion near the fixing projection b to the upper portion. And the fixing ring 32 is fixed to the  
30 extension pipe 3 by a screw(not shown).

The locking unit 40 includes a pair of suspension holes 41 formed to face each other at both sides of the

lower body unit 21, a pair of lockers 43 which are hinge-combined to a pair of locker supporting units 42 formed at both sides of the upper portion of the dirt collecting tub 30 and have hooks 43a hooked to the suspension holes 41 and formed at the end thereof, and a pair of springs 44 which are placed between the inside of the rear end of the locker 43 and the locker supporting unit 42 of the dirt collecting tub 30 and elastically support the lockers 43 in one direction.

10 The locker supporting unit 42 is generally formed to be of U shape, a pair of hinge holes 42a and a spring supporting projection 42b are formed at predetermined positions, respectively. The locker 43 is placed to be  
15 rotated by a predetermined angle around the hinge projection 43b by the insertion of a pair of hinge projections 43b to the hinge holes 42a of the locker supporting unit 42. A spring supporting projection 43c for supporting the spring 44 is formed at the inner surface of  
20 the locker 43. Here, the spring 44 elastically supports the locker 43 in the direction which the hook 43a is hooked in the suspension hole 41. Thus, if the dirt collecting tub 30 is inserted to the lower body unit 21 of the cyclone body 20, the hook 43a of the locker 43 is  
25 inserted in the suspension hole 41 and then the dirt collecting tub 30 is combined to the cyclone body 20. The dirt collecting tub 30 can be separated from the cyclone body 20 by pushing and pulling both lockers 43. Then, the hooks 43a of the lockers 43 are released from the  
30 suspension hole 41 of the lower body unit 21 and the supporting unit 31 at the lower portion of the dirt collecting tub 30 is released from the fixing ring 32 of the extension pipe 3, thereby conveniently removing the

dirt collected inside of the dirt collecting tub 30 by separating only the dirt collecting tub 30.

In the meanwhile, a reference numeral 50 represents a dirt separating grill. The dirt separating grill 50 serves to prevent the dust from flowing backward together with the air via the air outlet 12a of the cyclone body 20 when the cyclone dust collecting device is operated. The dirt separating grill 50 is placed to be downwardly extended from the air outlet 12a and has a plurality of minute passing holes 50a, so that the air risen from the dirt collecting tub 30 is exhausted via the minute passing holes 50a, while the dirt larger than the minute passing holes cannot pass through the passing holes 50a but are descended again to be collected at the dirt collecting tub 30.

The dirt separating grill 50 has a grill guide unit 51 formed at the upper portion, a conical shape grill unit 52 the inside of which is hollow and a cylinder shape grill unit 53 the lower portion of which is blocked. These are united into one. The minute passing holes 50a are formed at the remaining portions except a predetermined portion near the air inlet 11a of the conical shape grill unit 52 and at the whole circumference of the cylinder shape grill unit 53.

The grill guide unit 51 is supported by the curve ribs 22a and 21a formed at the upper and lower body units 22 and 21, to place the dirt separating grill 50. A rib groove 51a for receiving the curve rib 22a of the upper body unit 22 is formed at the edge of the upper surface of the grill guide unit 51 and an end jaw unit 51b to which

the curve rib 21a of the lower body unit 21 is closely mounted is formed at the other surface thereof.

In addition, a dirt blocking plate 60 of conical shape in which the width of the lower portion is greater than that of the upper portion is formed at the lower end of the dirt separating grill 50 to be united into one.

The dirt blocking plate 60 serves to block the dirt risen together with the air before the dirt reaches the dirt separating grill 50 and to descend the dirt again. Accordingly, the dirt like the toilet paper cannot completely rise to the upper portion of the cyclone body 20 but is blocked to be descended again, so that it is possible to remarkably reduce the quantity of the dirt flowing backward via the minute passing holes 50a of the dirt separating grill 50, and it is also possible to prevent the dirt like toilet paper from blocking the minute passing holes 50a of the dirt separating grill 50.

Hereinafter, a description will be made on the operation of the vacuum cleaner having the cyclone dust collecting device as described above.

If electric power is applied, the suctioning force is produced by the driving of a motor in the main body 1 of the cleaner. Then, the dirt like dust enters the inside of the cyclone dust collecting device via the suction opening and the first connecting tube 11 together with the suction air, as shown in Figure 5. In this case, the air which enters the cyclone dust collecting device flows in a slanting direction against the cyclone body 20 by the air inlet 11a of the first connecting tube 11. Accordingly,



the air produces whirlpool air current and is descended to the lower portion of the dirt collecting tub 30. In this process, the dirt of large particle or the dirt like the toilet paper or vinyl contained in the air is separated from the air by the centrifugal force and is descended along the inner side wall of the dirt collecting tub to be collected at the dirt collecting tub 30. And the air starts the reverse rising movement from the bottom of the dirt collecting tub 30 and is exhausted to the main body 1 of the cleaner via the air outlet 12a and the second connecting tube 12 by the rising air current with being rotated with a smaller radius. In this case, the dirt risen together with the air by the rising air current cannot pass through the minute passing holes 50a of the dirt separating grill 50 and is descended again to be collected at the dirt collecting tub 30. And some of comparatively large dirts are run against the dirt blocking plate 60 and then are descended again to be collected. The dust collecting and heaping process performed at the main body 1 is the same as that of a general vacuum cleaner.

If the dirt collecting tub 30 is filled with the dirt which has been separated and collected by such a process, the collected dirt is removed by separating only the dirt collecting tub 30 from the cyclone body 20 without separating the cyclone dust collecting device from the extension pipe.

In the meanwhile, Figure 6 is an exploded perspective view showing a cyclone dust collecting device according to a second preferred embodiment of the present invention, and Figure 7 is a cross sectional view for explaining the

dust collecting operation of the cyclone dust collecting device of Figure 6.

As shown in the figures, the basic construction of the cyclone dust collecting device according to a second preferred embodiment of the present invention is the same as that according to the first preferred embodiment of the present invention except that in constructing the dirt blocking unit at the lower portion of the dirt separating grill 50, an additional dirt blocking rotation plate 60' is placed to be rotated by the rising air.

The dirt blocking rotation plate 60' is rotated by the whirlpool air current produced inside of the dirt collecting tub 30, thereby effectively descending various dirt which run against the dirt blocking rotation plate 60'.

Here, the dirt blocking rotation plate 60' is of a conical shape in which the width of the lower portion is greater than that of the upper portion. The protrusion 60a formed at the center of the upper portion of the dirt blocking rotation plate 60' is inserted to an axis hole formed at the center of the lower portion of the dirt separating grill 50, and this enables the dirt blocking rotation plate 60' to be rotated. The construction of such a dirt blocking rotation plate is well known in the art.

The other constructions and the operating effect are the same as those of the first preferred embodiment of the present invention and the detailed description thereof will be omitted.

Figure 8 is an exploded perspective view showing a cyclone dust collecting device according to a third preferred embodiment of the present invention and Figure 9 is a cross sectional view for explaining the dust collecting operation of the cyclone dust collecting device of Figure 8.

The cyclone dust collecting device according to a third preferred embodiment of the present invention has a supplement blocking member 70 for supplementing the operation of the dirt blocking plate 60.

The supplement blocking member 70 may be formed of brush and is placed along the edge of the lower end of the dirt blocking plate 60. In this case, the supplement blocking member 70 is placed to be widely distributed with maintaining the same angle as the downward extension unit of the dirt blocking plate 60.

Accordingly, it is possible to more effectively block the dirt risen together with the air in the dirt collecting tub 30.

The other constructions and the operating effect are the same as those of the first and second preferred embodiments of the present invention and the detailed description thereof will be omitted.

Figure 10 is an exploded perspective view showing a cyclone dust collecting device according to a fourth preferred embodiment of the present invention and Figure 11 is a cross sectional view for explaining the dust collecting operation of the cyclone dust collecting device of Figure 10. Figure 12 is a cross sectional view showing

a cyclone dust collecting device according to a fifth preferred embodiment of the present invention.

The basic construction of the cyclone dust collecting device according to the fourth and fifth preferred embodiments of the present invention is the same as that according to the first preferred embodiment of the present invention except that the dirt collecting tub 30 is composed of a first cylinder unit 30a with a predetermined diameter  $d_1$  which is formed at the upper portion thereof and a second cylinder unit 30b which is formed at the lower portion thereof and has a greater diameter than the first cylinder unit 30a.

Accordingly, the whirlpool air current produced in the dirt collecting tub 30 rotates at a comparatively high speed in the first cylinder unit 30a and rotates at a relatively slow speed in the second cylinder unit 30b. Thus, it is possible to minimize the quantity of the dirt which has risen from the bottom of the second cylinder unit 30b with the whirlpool air current.

Here, the second cylinder unit 30b may be formed to be a conical shape in which the diameter of the upper portion is smaller than that of the lower portion, as shown in Figure 11, or to be a simple cylinder shape the diameter of which is greater than that of the first cylinder unit 30a, as shown in Figure 12.

The other constructions and the operating effect are the same as those of the first and second preferred embodiments of the present invention and the detailed description thereof will be omitted.

As described above, since the dirt of large particle and the dirt like toilet paper contained among the air suctioned via the suction opening are primarily collected by the cyclone dust collecting device, the present  
5 invention can remarkably reduce the quantity of the dirt collected at the paper filter of the main body of the cleaner. Therefore, it is possible to extend the period for replacing the paper filter.

10 In addition, if the dirt collecting tub of the cyclone dust collecting device is filled with the dirt, the dirt can be removed by simply separating the dirt collecting tub without separating the cyclone dust collecting device from the extension pipe.

15 Further, according to the other preferred embodiments of the present invention, it is possible to effectively prevent the backward flowing of the dirt collected at the dirt collecting tub, thus reducing the quantity of the  
20 dirt collected at the paper filter. Hence, the life expectancy of the paper filter can be extended.

In addition, according to the other preferred embodiments of the present invention, since it is not  
25 happened that the dirt like toilet paper collected at the dirt collecting tub is caught in the dirt separating grill to choke the minute passing holes of the dirt separating grill, it is possible to prevent the overload of the cyclone dust collecting device or the motor as well as to  
30 prevent the deterioration of the cleaning efficiency.

Although the preferred embodiments of the present invention has been described, it will be understood by

those skilled in the art that the present invention should not be limited to the described preferred embodiment, but various changes and modifications can be made within the scope of the invention as defined by the appended claims.

5

The reader's attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings), may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extend to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel

combination, of the steps of any method or process so disclosed.

**CLAIMS**

1. A cyclone dust collecting device positionable within  
an extension pipe connecting a main body of a vacuum  
5 cleaner and a suction opening, the cyclone dust collecting  
device being arranged to separate and collect dust and  
dirt of comparatively large particle sizes suctioned from  
said suction opening together with air by means of  
centrifugal force, the cyclone dust collecting device  
10 being characterised in that the device does not share the  
same central axis as the extension pipe and that dirt  
collected within said cyclone dust collecting device may  
be conveniently removed without requiring separation of  
the device from said extension pipe.

15

2. A vacuum cleaner including a cyclone dust collecting  
device according to claim 1.

3. A vacuum cleaner having a cyclone dust collecting  
20 device which is placed at an extension pipe connecting a  
main body of the cleaner and a suction opening and  
separates and collects dust and dirt of comparatively  
large particle size suctioned from said suction opening  
together with air by means of centrifugal force,  
25 characterized in that said cyclone dust collecting device  
is placed in a different axis against said extension pipe,  
to thereby conveniently remove the dirt collected at said  
cyclone dust collecting device without separating said  
extension pipe of the cleaner.

30

4. The vacuum cleaner as claimed in claim 2 or 3, wherein  
said cyclone dust collecting device comprises:



a cyclone body having a first connecting tube connected to the extension pipe from said suction opening, a second connecting tube connected to the extension pipe from said main body, an air inlet formed at one side thereof to communicate with said first connecting tube, and an air outlet formed at the other side thereof to communicate with said second connecting tube, and for producing whirlpool air current for the dirt-containing air suctioned via said air inlet;

10

a dirt collecting tub combined to said cyclone body, and for collecting the dirt separated from the air by the whirlpool air current of said cyclone body; and

locking means for removably supporting said dirt collecting tub with respect to said cyclone body.

5. The vacuum cleaner as claimed in claim 4, wherein said cyclone body includes a lower body unit having said first connecting tube and said air inlet, an upper body unit having said second connecting tube and said air outlet, and a plurality of screws for combining said lower and upper body units to each other.

6. The vacuum cleaner as claimed in claim 4 or 5, wherein a dirt separating grill having a plurality of minute passing holes for preventing the dirt from flowing backward via said air outlet together with the air is mounted to be downwardly extended from said air outlet.

30

7. The vacuum cleaner as claimed in claim 6, wherein said dirt separating grill is formed in one body with a grill guide unit having a rib groove to which a curve rib for

defining the boundary of said air outlet in said cyclone body is inserted, a conical grill unit the inside of which is hollow, and a cylinder grill unit the lower end of which is closed, a plurality of minute passing holes being  
5 formed in portion except a predetermined portion near said air inlet of said conical grill unit and in the whole circumferential surface of said cylindrical grill unit.

8. The vacuum cleaner as claimed in claim 6 or 7, wherein  
10 dirt blocking means is disposed at the lower end of said dirt separating grill to block the dirt risen together with the air by the rising air current in said dirt collecting tub before the dirt reaches the dirt separating grill and then to descend the dirt again.

15 9. The vacuum cleaner as claimed in claim 8, wherein said dirt blocking means is formed by uniting in one body a dirt blocking plate to the lower end of said dirt separating grill, said dirt blocking means being in a  
20 conical shape the lower diameter of which is greater than the upper diameter.

10. The vacuum cleaner as claimed in claim 8 or 9, wherein  
25 a supplementary blocking member for supplementing the operation of said dirt blocking plate is disposed to be widely spread with maintaining the same angle as the downward extension unit of said dirt blocking plate.

11. The vacuum cleaner as claimed in claim 8, 9 or 10,  
30 wherein said dirt blocking means has an additional conical dirt blocking rotation plate disposed at the lower end of said dirt separating grill, the additional conical dirt

blocking rotation plate being rotated by the whirlpool air current.

12. The vacuum cleaner as claimed in claim 4, wherein a  
5 supporting unit for supporting said dirt collecting tub  
against said extension pipe is united in one body to one  
side of lower circumference of said dirt collecting tub,  
and a fixing ring having a slide groove to which said  
supporting unit is inserted is disposed at the extension  
10 pipe of the cleaner.

13. The vacuum cleaner as claimed in claim 12, wherein  
said supporting unit includes a fixing projection having a  
suspension jaw which is fixed by being inserted to said  
15 slide groove of said fixing ring, and a guide projection  
which is formed in front of said fixing projection and  
guides the insertion of said fixing projection to said  
slide groove.

20 14. The vacuum cleaner as claimed in claim 12, wherein  
said dirt collecting tub is formed in a cylinder shape  
with a predetermined diameter.

15. The vacuum cleaner as claimed in claim 12, wherein  
25 said dirt collecting tub is formed in a cylinder shape the  
lower diameter of which is smaller than the upper  
diameter.

16. The vacuum cleaner as claimed in claim 12, wherein  
30 said dirt collecting tub is comprised of a first cylinder  
unit with a predetermined diameter formed at the upper  
portion, and a second cylinder unit which is formed at the

lower portion and has a diameter greater than said first cylinder unit has.

17. The vacuum cleaner as claimed in claim 16, wherein  
5 said second cylinder unit is formed in a conical shape the lower diameter of which is greater than the upper diameter.

18. The vacuum cleaner as claimed in claim 5, wherein said  
10 locking means comprises:

a pair of suspension holes formed at both sides of said lower body unit;

15 a pair of lockers having hooks at one end thereof, and hinged to a pair of locker supporting units formed in one body at both sides of the upper portion of said dirt collecting tub, the hooks being hooked in said suspension hole; and

20

a spring disposed between the inside of the rear end of said locker and the locker supporting unit of said dirt collecting tub, and for elastically supporting said locker in one direction.

25

19. A vacuum cleaner comprising:

a cyclone dust collecting device disposed in a different axis with respect to an extension pipe  
30 connecting a main body of the cleaner and a suction opening, and for separating and collecting dust and dirt of comparatively large particle which are suctioned via

said suction opening together with air by the centrifugal force, said cyclone dust collecting device comprising:

5 a cyclone body having first and second connecting tubes connected to said extension pipe of the cleaner, an air inlet formed at one side thereof to communicate with said first connecting tube and an air outlet formed at the other side thereof to communicate with said second connecting tube, and for producing whirlpool air current  
10 for the suctioned air;

a dirt collecting tub combined to said cyclone body, and for collecting the dirt separated from the air by the whirlpool air current of said cyclone body;

15

a dirt separating grill downwardly extended from said air outlet, and having a plurality of minute passing holes for preventing the dirt from flowing backward via said air outlet together with the air;

20

dirt blocking means disposed at the lower end of said dirt separating grill to block the dirt risen together with the air by the rising air current before the dirt reaches said dirt separating grill and then to descend the  
25 dirt again; and

locking means for removably supporting said dirt collecting tub with respect to said cyclone body.

30 20. The vacuum cleaner as claimed in claim 19, wherein said cyclone body includes a lower body unit having said first connecting tube and said air inlet, an upper body unit having said second connecting tube and said air

outlet, and a plurality of screws for combining said upper and lower body units to each other.

21. The vacuum cleaner as claimed in claim 19, wherein  
5 said dirt separating grill is formed in one body with a grill guide unit having a rib groove to which a curve rib for defining the boundary of said air outlet in said cyclone body is inserted, a conical grill unit the inside  
10 of which is hollow, and a cylinder grill unit the lower end of which is closed, a plurality of minute passing holes being formed in portion except a predetermined portion near said air inlet of said conical grill unit and in the whole circumferential surface of said cylinder grill unit.

15 22. The vacuum cleaner as claimed in claim 19, wherein said dirt blocking means is formed by uniting in one body a dirt blocking plate to the lower end of said dirt separating grill, said dirt blocking means being in a  
20 conical shape the lower diameter of which is greater than the upper diameter.

23. The vacuum cleaner as claimed in claim 19, wherein a supporting unit for supporting said dirt collecting tub  
25 against said extension pipe is united in one body to one side of lower circumference of said dirt collecting tub, and a fixing ring having a slide groove to which said supporting unit is inserted is disposed at the extension pipe of the cleaner.

30 24. The vacuum cleaner as claimed in claim 23, wherein said supporting unit includes a fixing projection having a suspension jaw which is fixed by being inserted to said

slide groove of said fixing ring, and a guide projection which is formed in front of said fixing projection and guides the insertion of said fixing projection to said slide groove.

5

25. The vacuum cleaner as claimed in claim 20, wherein said locking means comprises:

a pair of suspension holes formed at both sides of  
10 said lower body unit;

a pair of lockers having hooks at one end thereof, and hinged to a pair of locker supporting units formed in one body at both sides of the upper portion of said dirt  
15 collecting tub, the hooks being hooked in said suspension hole; and

a spring disposed between the inside of the rear end of said locker and the locker supporting unit of said dirt  
20 collecting tub, and for elastically supporting said locker in one direction.

26. A cyclone dust collecting device substantially as herein described with reference to Figures 2 to 5, or  
25 according to Figures 2, 6 and 7, or according to Figures 2, 8 and 9, or according to Figure 2, 10 and 11, or according to Figure 2 and 12.

27. A vacuum cleaner substantially as herein described  
30 with reference to Figures 2 to 5, or Figures 2, 6 and 7, or Figures 2, 8 and 9, or Figures 2, 10 and 11, or Figures 2 and 12.



Application No: GB 9921385.2  
Claims searched: 1-27

Examiner: Annabel Ovens  
Date of search: 21 December 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): A4F (FFD, FSCH, FSCX, FSNX, FSSX)

Int Cl (Ed.6): A47L (5/00, 9/16)

Other: Online: PAJ, EPODOC, WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X, Y	EP 0827710 A2 (AKTIEBOLUNG ELECTROLUX) see column 2 lines 6-10, column 3 line 34-column 4 line 5 and Fig. 4	X: 1-3 Y: 4
Y	US 5350432 (LEE) see column 2 lines 3-18, column 4 lines 14-22 and Figs. 2 and 5	Y: 4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.